

Remarks/Arguments

Claims 1, 69 and 73 have been amended. Claims 1-78 are in the application. Entry of this amendment and reexamination and reconsideration of the present application are respectfully requested in the light of the above amendments and the following remarks.

Claims 1, 69 and 73 have been amended to specify that the equilibrium limited chemical reaction is conducted "in a microchannel reactor comprising at least one process microchannel." These claims have also been amended to indicate that the first reaction zone and the another reaction zone are in the same process microchannel and are separated by non-reactive zone in the process microchannel not containing catalyst wherein the intermediate product composition is heated or cooled. Support for these amendments can be found in the Applicants' specification at page 9, lines 1-3 and page 25, lines 29-33.

Claims 1-9, 13-55, 57 and 60-73 have been rejected under 35 U.S.C. §103(a) as unpatentable over WO'346 (WO 2004/016346 A1) in view of Tonkovich '536 (U.S. 6,200,536).

WO '346 was published on February 26, 2004, which was subsequent to the filing date of February 11, 2004 for the present application, and therefore is not prior art with respect to the present application. In the office action mailed December 12, 2007, WO '346 was cited under 35 U.S.C. §102(e) as prior art, however, this was not a valid rejection since WO '346 did not designate the United States. Also, even if WO '346 was prior art under 35 U.S.C. §102(e), the present rejection, which is under 35 U.S.C. §103(a), would not be valid under 35 U.S.C. §103(c) since WO '346 and the present application are assigned to the same company (i.e., Velocys, Inc.). Since WO '346 is not prior art and cannot be used in the rejection, the rejection of claims 1-9, 13-55 and 60-73 under 35 U.S.C. §103(a) as unpatentable over WO '346 in view of Tonkovich '536 is not a valid rejection.

Withdrawal of the rejection of claims 1-9, 13-55, 57 and 60-73 as unpatentable over WO '346 in view of Tonkovich '536 is believed to be warranted and is respectfully requested.

Claims 1-73 and 75-78 have been rejected under 35 U.S.C. §103(a) as unpatentable over Ward et al. (WO 03/078052 A1) in view of Van Egmond (U.S.

2004/0127759 A1), O'Rear et al. (U.S. 6,703,429 B2), Brophy et al. (U.S. 7,294,734 B2) and Tonkovich '536. (Note that the lead inventor identified in Ward et al. is Ward E. TeGrotenhuis; the Examiner has referred to the reference as being "Ward et al.," and for purposes of consistency the Applicants will also refer to it as being "Ward et al."). Claim 74 has been rejected under 35 U.S.C. §103(a) as unpatentable over Ward et al. in view of Van Egmond, O'Rear et al., Brophy et al., Tonkovich '536 and Guillard et al. (U.S. 6,887,907). Claims 75-77 have been rejected under 35 U.S.C. §103(a) as unpatentable over Ward et al. in view of Van Egmond, O'Rear et al., Brophy et al., Tonkovich '536 and either Tonkovich '505 (U.S. 6,969,505) or Schmidt et al. (U.S. 6,452,001). These rejections are respectfully traversed.

Ward et al. discloses a microchannel device and a method of use wherein a reaction microchamber is in thermal contact with a heat exchange channel. An equilibrium limited exothermic chemical process is conducted in the reaction microchamber. Sufficient heat is transferred to the heat exchange channel to lower the temperature in the reaction microchamber down its length to substantially increase at least one performance parameter of the exothermic chemical process relative to isothermal operation. The Examiner admits that Ward et al. does not disclose the formation of an intermediate product composition in a first reaction zone with a first catalyst and a final product in a second reaction zone. Ward et al. does not disclose the use of a first reaction zone and a second reaction zone in the same process microchannel in a microchannel reactor wherein the reaction zones are separated by a non-reactive zone not containing catalyst as specified in the Applicants' amended claims 1, 69 and 73. The requirements of independent claims 1, 69 and 73 are clearly distinguishable from the teachings in Ward et al.

Claims 2-68 and 75-77 depend from claim 1 and are distinguishable from the teachings in Ward et al. for at least the same reasons as claim 1. Claims 70-72 depend from claim 69 and are distinguishable from the teachings in Ward et al. for at least the same reasons as claim 69.

Claim 74 is directed to a process for conducting a dimethyl ether synthesis reaction wherein in a first reaction zone in a microchannel reactor the approach to equilibrium for the conversion of CO is from about 75% to about 95%, and the approach to the equilibrium

for the conversion of CO in another reaction zone is from about 75% to about 95%. This is not disclosed in Ward et al.

Claim 78 is directed to a process for conducting an equilibrium limited chemical reaction in a microchannel reactor employing a first reaction zone and another reaction zone wherein the first reaction zone is heated or cooled by a first set of heat exchange channels and the another reaction zone is heated or cooled by another set of heat exchange channels. The first set of heat exchange channels is separate from the another set of heat exchange channels. This is not disclosed in Ward et al.

The Examiner cited O'Rear et al. for its disclosure of "a process for methanol synthesis wherein an intermediate is formed in a first reaction zone with a first catalyst and a final product is formed in a second reaction zone." The teachings in O'Rear et al. are clearly distinguishable from the requirements of the Applicants' claims 1-78. O'Rear et al. disclose a dual functional syngas conversion wherein syngas is converted to high molecular weight products via a methanol intermediate. Two different types of catalysts are used. A methanol intermediate is formed with the first catalyst. The methanol intermediate is then rapidly consumed over the second catalyst during the formation of the final products which are higher molecular weight products. O'Rear et al. does not suggest, as specified in the Applicants' claims 1-73 or 75-78, a multi-step process conducted in a microchannel reactor wherein a first reaction is conducted in a first reaction zone to form an intermediate product composition, another reaction is conducted in another reaction zone to form a final product, and the first reaction zone and the second reaction zone are separated by a non-reactive zone wherein the intermediate product composition is heated or cooled. The teachings in O'Rear et al. are also not relevant with respect to the Applicants' claim 74 since claim 74 is directed to a process for making dimethyl ether.

The examiner cited Van Egmond for its disclosure of methanol synthesis at a temperature in the range of 150-450°C. The teachings in Van Egmond are clearly distinguishable from the requirements of Applicants' claims 1-78. Van Egmond et al. discloses a process wherein a methanol synthesis system is integrated with a methanol to olefin reaction system which is clearly distinguishable from the process specified in the Applicants' claims 1-73 or 75-78. Van Egmond et al. does not suggest, as specified in the Applicants' claim 1-73 or 75-78, a multi-step process conducted in a microchannel reactor

wherein a first reaction is conducted in a first reaction zone to form an intermediate product composition, another reaction is conducted in another reaction zone to form a final product, and the first reaction zone and the second reaction zone are separated by a non-reactive zone wherein the intermediate product composition is heated or cooled. The disclosure in Van Egmond et al. is also distinguishable from claim 74 which relates to producing dimethyl ether.

Brophy et al. is cited for its teaching of "a method of methanol synthesis (col. 34) wherein a claimed pressure and contact time are employed (col. 34)." The rejection based on Brophy et al. is not a valid rejection. Brophy et al. is prior art against the present application under 35 U.S.C. §102(e) due to the fact that it issued on November 13, 2007, which was subsequent to the filing date of February 11, 2004 for the present application, but was filed on May 2, 2003, which was prior to the filing date of the present application. Brophy et al. and the present application are assigned to the same company (Velocys, Inc.). Since Brophy et al. is prior art against the present application under 35 U.S.C. §102(e) and since Brophy et al. and the present application are assigned to the same company, the rejection of claims 1-78 under 35 U.S.C. §103(a) based on the teachings in Brophy et al. is not a valid rejection under the provisions of 35 U.S.C. §103(c).

Tonkovich '536 is cited for its disclosure in Fig. 2(d) of a microchannel reactor configuration wherein the heat exchanger is disposed between two reactors. The microchannel reactor disclosed in Fig. 2(d) of Tonkovich '536 does not employ a process microchannel containing two reaction zones separated by a non-reactive zone as specified in the Applicants' amended claims 1, 69 and 73.

Guillard et al. is cited against claim 74 for its disclosure of a method for making dimethyl ether in a process employing two reactors. The two reactors disclosed in Guillard et al. are illustrated in the figure as reactor 11 and converter 15. In reactor 11, natural gas and oxygen are converted to synthesis gas. In converter 15, the synthesis gas is converted to dimethyl ether. This is clearly distinguishable from the requirements of claim 74 wherein the microchannel reactor contains two reaction zones wherein dimethyl ether is produced in each reaction zone.

Schmidt is cited against claims 75-77. In this rejection the Examiner contends that Schmidt et al. teach a method of oxidation of hydrocarbons wherein the claimed SLPM and

contact time is known for conversion reactions. Schmidt et al., however, does not disclosure or suggest conducting the reaction in a microchannel reactor comprising at least one process microchannel wherein a first reaction zone and another reaction zone are positioned in the same process microchannel and these reaction zones are separated by a non-reactive zone not containing catalyst as specified in claims 75-77.

The rejection of claims 75-77 based on Tonkovich '505 is not a valid rejection. Tonkovich '505 is prior art against the present application under 35 U.S.C. §102(e) due to the fact that it issued on November 29, 2005, which was subsequent to the filing date of February 11, 2004 for the present application, but was filed on August 15, 2002, which was prior to the filing date of the present application. Tonkovich '505 and the present application are assigned to the same company (Velocys, Inc.). Since Tonkovich '505 is prior art against the present application under 35 U.S.C. §102(e) and since Tonkovich '505 and the present application are assigned to the same company, the rejection of claims 75-77 under 35 U.S.C. §103(a) based on the teachings in Tonkovich '505 is not a valid rejection under the provisions of 35 U.S.C. §103(c).

Withdrawal of the rejection of claims 1-78 is believed to be warranted and is respectfully requested.

Applicants respectfully submit that the application is in condition for allowance. A Notice of Allowance is respectfully requested. In the event the Examiner would like to discuss any matters concerning this application, he is invited to contact the undersigned attorney by telephone. Any fees required for the filing of this paper may be charged to Deposit Account Number 18-0988.

Respectfully submitted,

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